

Revised correlation between Odin/OSIRIS PMC properties and coincident TIMED/SABER mesospheric temperatures

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The Optical Spectrograph and Infrared Imaging System (OSIRIS) instrument on board the Odin satellite detects Polar Mesospheric Clouds (PMCs) through the enhancement in the limb-scattered solar radiance. The Sounding of the Atmosphere using the Broadband Emission Radiometry (SABER) instrument on board the TIMED satellite is a limb scanning infrared radiometer that measures temperature and vertical profiles and energetic parameters for minor constituents in the mesosphere and lower thermosphere. The combination of OSIRIS and SABER data has been previously used to statistically derive thermal conditions for PMC existence [Petelina et al., 2005].

In this work, we employ the simultaneous common volume measurements of PMCs by OSIRIS and temperature profiles measured by SABER for the Northern Hemisphere summers of 2002-2005 and corrected in the polar region by accounting for the vibrational-vibrational energy exchange among the CO₂ isotopes [Kutepov et al., 2006]. For each of 20 coincidences identified within +/- 1 degree latitude, +/- 2 degrees longitude and <1 hour time the frost point temperatures were calculated using the corresponding SABER temperature profile and water vapor densities of 1, 3, and 10 ppmv.

We found that the PMC presence and brightness correlated only with the temperature threshold that corresponds to the frost point. The absolute value of the temperature below the frost point, however, didn't play a significant role in the intensity of PMC signal for the majority of selected coincidences. The presence of several bright clouds at temperatures above the frost point is obviously related to the limitation of the limb geometry when some near- or far-field PMCs located at higher (and warmer) altitudes appear to be at lower altitudes.

S.V. Petelina, D.A. Degenstein, E.J. Llewellyn, N.D. Lloyd, C.J. Mertens, M.G. Mlynczak, and J.M. Russell III, Thermal conditions for PMC existence derived from Odin/OSIRIS and TIMED/SABER data, Geophys. Res. Lett. 32, L17813, doi: 10.1029/2005GL023099 (2005)

A.A. Kutepov, A.G. Feofilov, B.T. Marshall, L.L. Gordley, W. D. Pesnell, R.A. Goldberg, and J.M. Russell III, SABER temperature observations in the summer polar mesosphere and lower thermosphere: importance of accounting for the CO₂-nu₂ quanta V-V exchange, accepted for publication in Geophys. Res. Lett. (2006)